

Solutions

2.1 B $r=(1-2)/(1+2)=-1/3$; $R=1/9$.

Compare the rejected options: 0; $1/3$; $4/9$; 1. Use the stated model and conditions.

2.2 C $N=1$ gives triples $(1,0,0), (0,1,0), (0,0,1)$.

Compare the rejected options: 1; 2; 4; 6. Use the stated model and conditions.

2.3 15. $(N+1)(N+2)/2=5 \cdot 6/2=15$.

2.4 False. Their products change sign on reversing order; they anticommute.

3.1 Norm is $(3+1)/4 = 1$. S_z gives $+\hbar/2$ with probability $3/4$ and $-\hbar/2$ with probability $1/4$. The x eigenstates are $(1, \pm 1)^T/\sqrt{2}$. Their amplitudes are $(\sqrt{3} \pm i)/(2\sqrt{2})$, each with squared modulus $1/2$. Award norm, z results/probabilities, x eigenbasis, projections and x probabilities. Complex conjugation is required in the inner product; the imaginary relative phase matters.